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(12) United States Patent Gandhi et al.

(54) STACKABLE WING FOR AN AEROCAR

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(56) References Cited

U.S. PATENT DOCUMENTS

1,412,455 A *	4/1922	Crowell 244/219
4,537,373 A	8/1985	Butts 244/22
6,199,796 B1	3/2001	Reinhard et al.
6,786,450 B1	9/2004	Einstein 244/2
7,766,281 B2 *	8/2010	Lorkowski et al 244/215
7,874,512 B2 *	1/2011	Xu 244/2
8,186,631 B2	5/2012	Iannucci
8,262,032 B2	9/2012	Sanderson et al.
2012/0134838 A13	5/2012	Ramirez Jimenez et al 416/229
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^{*} cited by examiner

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(57) ABSTRACT

A wing includes an upper surface that forms a generally fixed shape and a lower surface adjacent to the upper surface. The lower surface is morphable between a stowed shape and a deployed shape. A method of morphing a wing includes morphing a lower surface between a stowed shape and a deployed shape. The lower surface curves toward the upper surface in the stowed shape and curves away from the upper surface in the deployed shape.

16 Claims, 3 Drawing Sheets

